

# Habitat Assessment and Restoration Planning (HARP) Model



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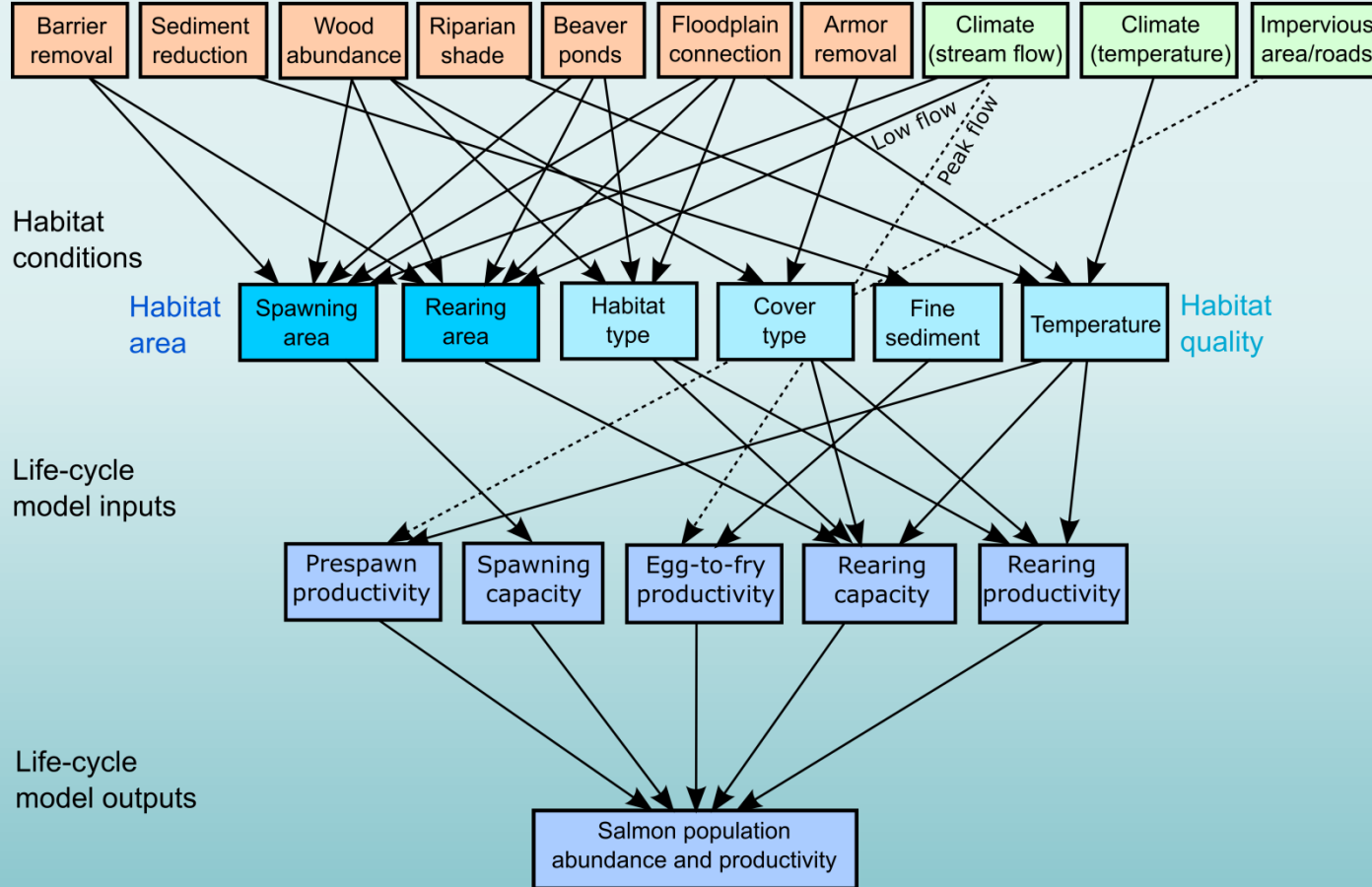
NOAA Fisheries, Northwest Fisheries Science Center, Seattle, WA

# HARP Model Structure

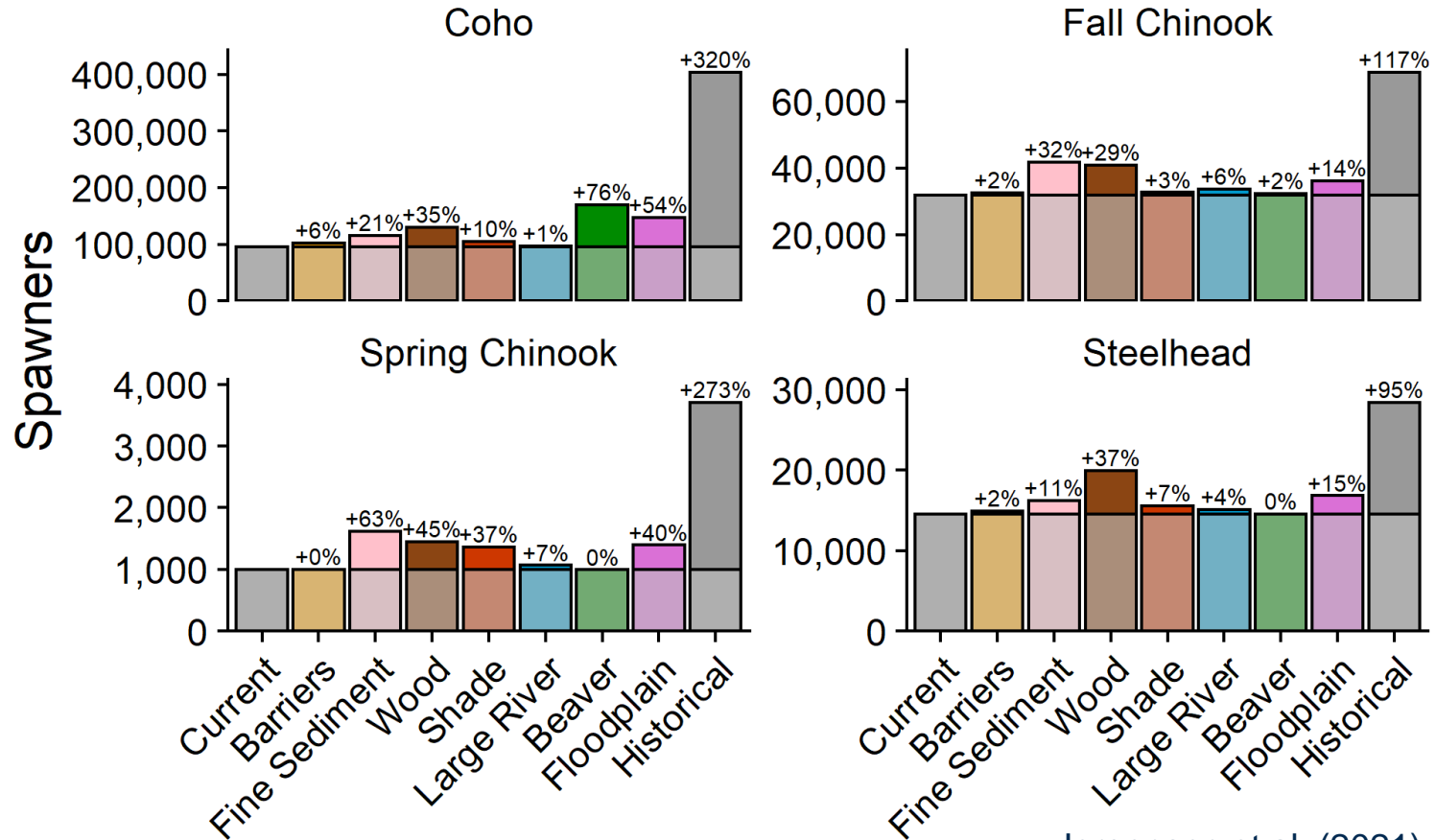
Drivers

Potential restoration actions

External drivers

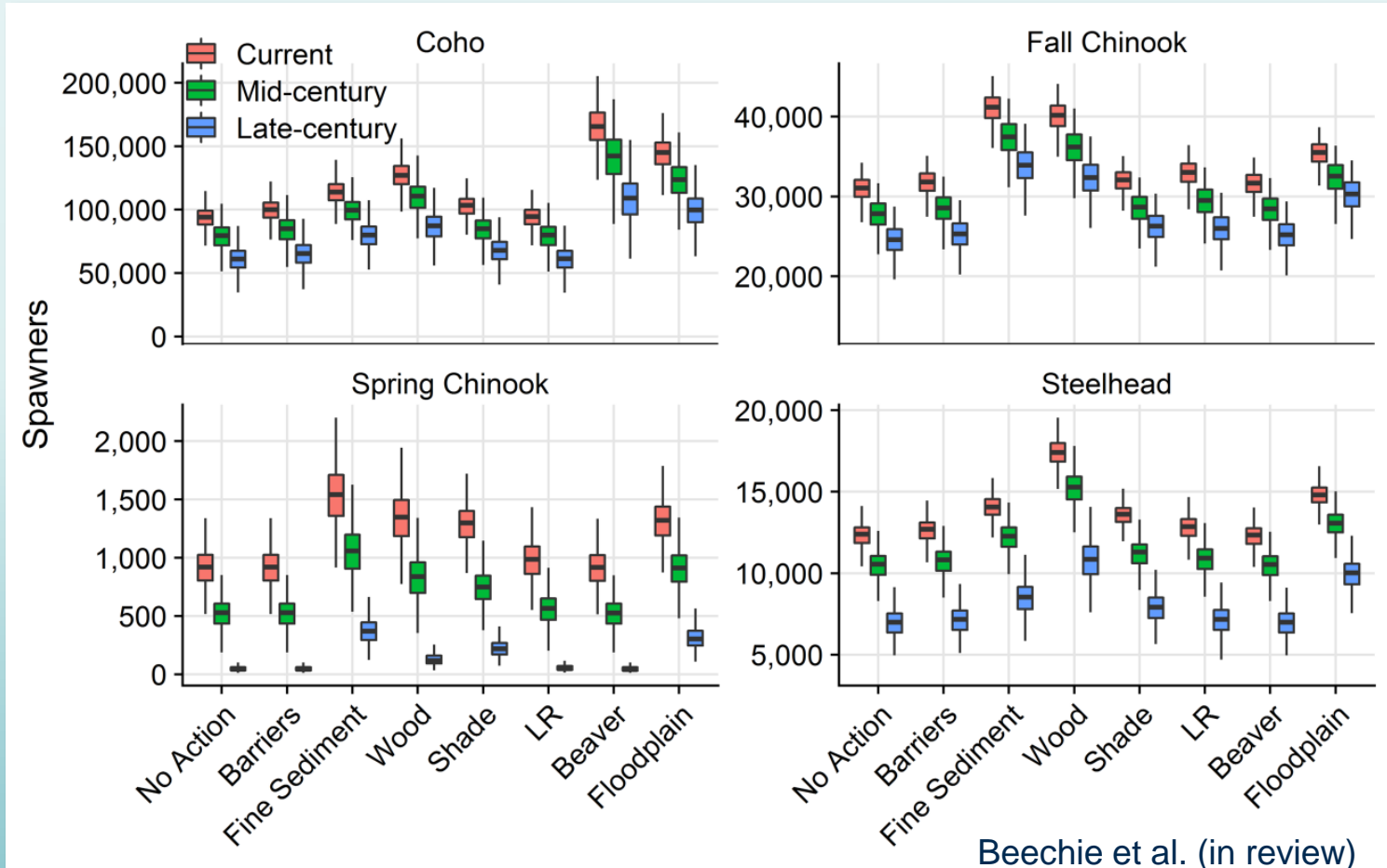


# Which restoration actions are most important?



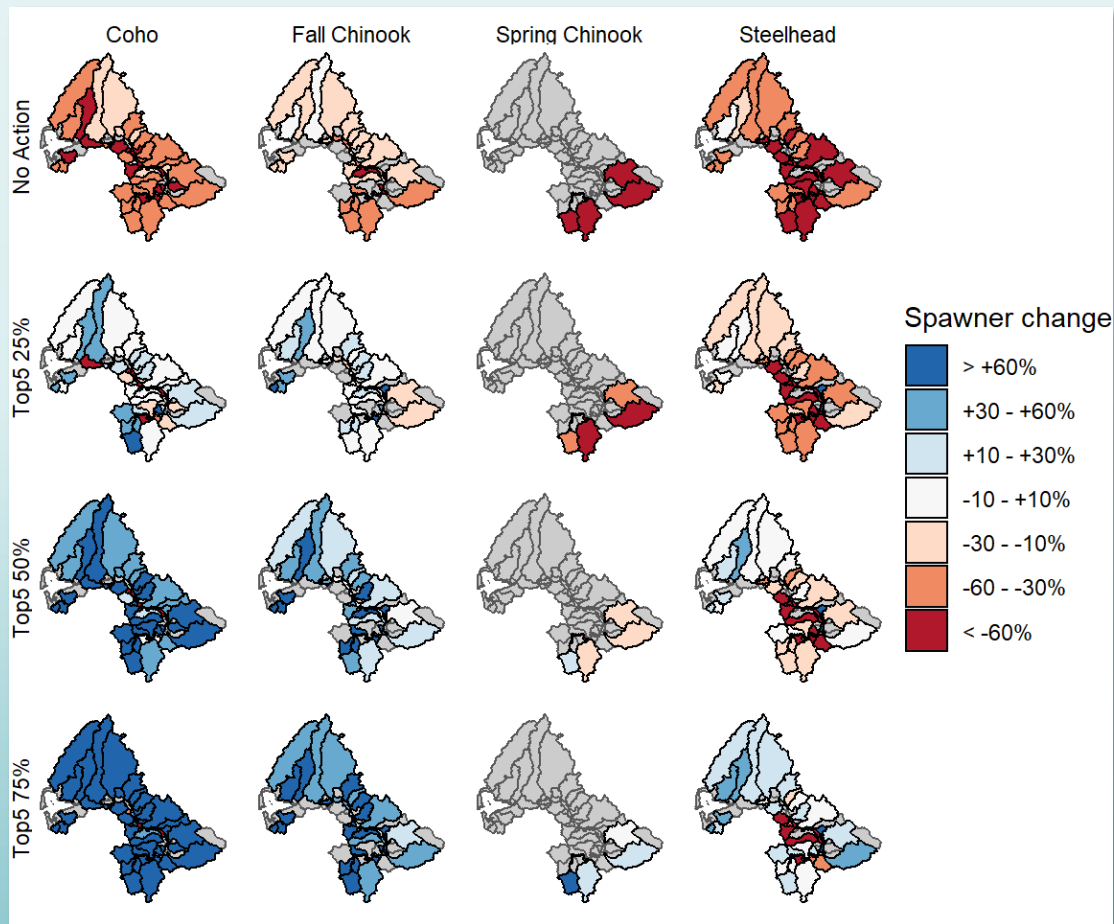
Jorgensen et al. (2021)

# What are the likely effects of climate change?



# Also models combinations of actions

- Top 5 actions at intensities of 25%, 50% and 75%
- Late century abundance (change from current to 2080s)

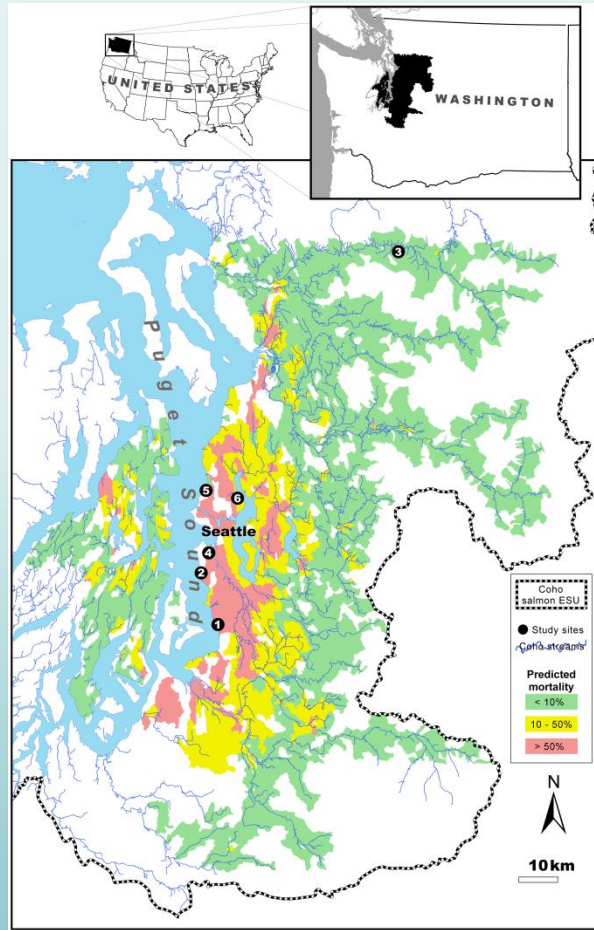


# Model updates for Puget Sound application

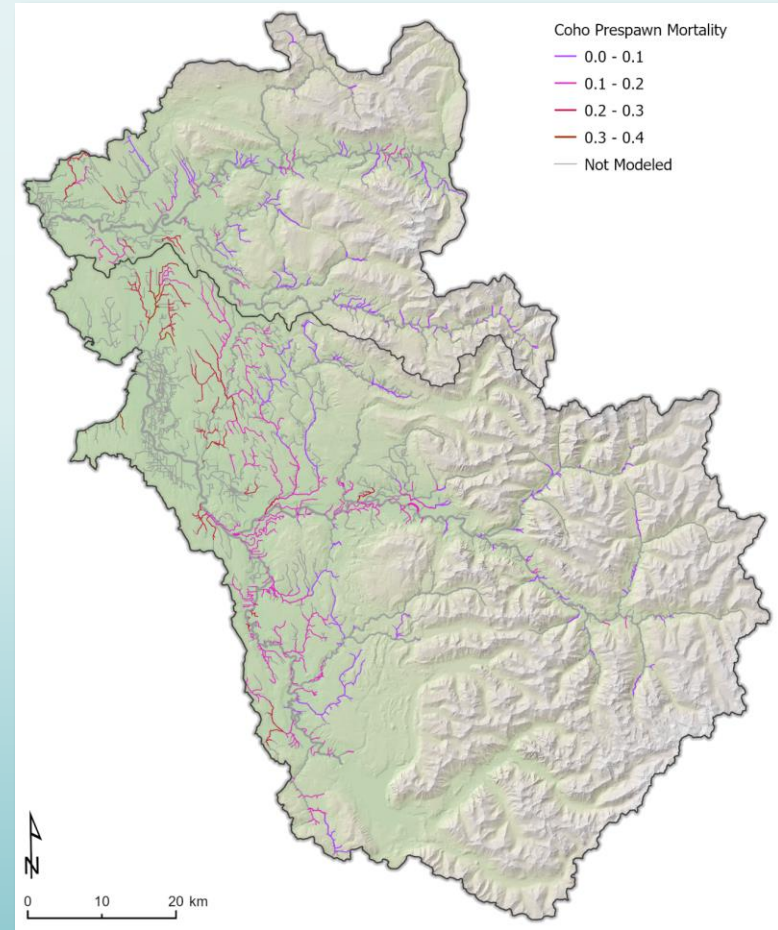
- Currently modeling Stillaguamish and Snohomish basins
- Updated prespawn mortality function (Feist et al. 2017)
- Models summer-run and winter-run steelhead
- Adds yearling outmigrant life history to Chinook model



# Effects of roads and impervious surfaces



Data from Feist et al. (2017)



Applied to spawning reaches

# More information

- <https://www.fisheries.noaa.gov/resource/tool-app/habitat-assessment-and-restoration-planning-harp-model>
- Feist, B. E., E. R. Buhle, D. H. Baldwin, J. A. Spromberg, S. E. Damm, J. W. Davis, and N. L. Scholz. 2017. Roads to ruin: conservation threats to a sentinel species across an urban gradient. *Ecological Applications* 27:2382–2396.
- Beechie, T., C. Fogel, C. Nicol, J. Jorgensen, B. Timpane-Padgham, P. Kiffney. In review. Can habitat restoration increase salmon resilience to climate change? *Ecosphere*.
- Beechie, T., C. Nicol, C. Fogel, B. Timpane-Padgham. 2021. A process-based assessment of landscape change and salmon habitat losses in the Chehalis River basin, USA. *PLoS ONE* 16(11):e0258251.
- Jorgensen, J., C. Nicol, C. Fogel, and T. Beechie. 2021. Identifying the potential of anadromous salmonid habitat restoration with life cycle models. *PLoS ONE* 16(9):e0256792.